

REMARKS

In the Office Action, dated June 23, 2003, the Examiner states that Claims 29-54 are pending, Claims 29, 30, 34-45, 49, 50, 52 and 54 are rejected and Claims 31-33, 46-48, 51 and 53 are allowed. By the present Amendment, Applicant amends the claims.

In the Office Action, Claim 49 is rejected under 35 U.S.C. §112, second paragraph as being indefinite. The Applicant has amended the dependency of that claim to overcome the rejection.

In the Office Action, Claims 29, 30, 34-45, 49, 50, 52 and 54 are rejected under 35 U.S.C. §103(a) as being unpatentable over WO99/08158 in view of EP 0 665 449. Claims 31-33, 46-48, 51 and 53 have been allowed. The Applicant thanks the Examiner for allowing the above claims. The Applicant has amended independent Claims 29 and 44 to incorporate the features of Claims 34 and 35, and considers the amended claims to be novel for the below-described reasons.

With regard to Claim 29, the photocatalyst-containing layer is limited in that it "contains fluorine and the photocatalyst-containing layer is formed so that the fluorine content in a surface of the photocatalyst-containing layer is reduced by an action of the photocatalyst upon irradiating the photocatalyst-containing layer with the energy as compared with before the energy irradiation, and the fluorine content in a part in which the fluorine content is reduced by irradiating the photocatalyst-containing layer with the energy is 10 or less relative to 100 of the fluorine content of a part not irradiated with the energy".

As mentioned above, the photocatalyst-containing layer contains fluorine, and the fluorine content of the part, in which the fluorine content is reduced by irradiation with the energy, is 10% or less of the fluorine content of the part not irradiated with the energy. In other words, a sufficient wettability difference between the energy irradiated part and the unirradiated part can be provided

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because the fluorine content is reduced by 90% or more by the energy irradiation. Therefore, even in a case where a black matrix is not formed inbetween the pixels, the pixels can be coated divisionally by the ink jet method and a high resolution color filter without defects such that a color mixture can be formed.

On the other hand, there is no description about the fluorine content being greatly reduced by the energy irradiation in either of the cited references WO99/08158 and EP 0 665,449. Therefore, neither of the references have the above mentioned peculiar effect to the present invention, "even in the case where black matrix is not formed in between the pixels, the pixels can be coated divisionally by the ink jet method and a high resolution color filter without defects such as color mixture can be formed".

For the above reasons the Applicant considers the amended Claim 29, and those claims dependent thereon, to overcome the rejection under 35 U.S.C. §103(a).

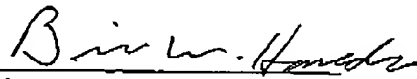
With regard to independent Claim 44, the features of Claims 34 and 35 have also been added to that claim. Therefore, the Applicant also considers amended Claim 44, and the claims dependent thereon, to overcome the rejection under 35 U.S.C. §103(a).

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In light of the foregoing response, all the outstanding objections and rejections have been overcome. Applicant respectfully submits that this application should now be in better condition for allowance and respectfully requests favorable consideration.

Respectfully submitted,

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Date


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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Masato Okabe et al.) Group Art Unit: 1756
SERIAL NO: 09/607,010) Examiner: John A. McPherson
FILED: June 29, 2000)
TITLE: Color Filter and Process for Producing the Same

THE COMMISSIONER FOR PATENTS
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AMENDED CLAIMS

1. - 28. (Cancelled)

29. (Currently Amended) A color filter, in which a shading part provided on a border part of a picture element part is not formed, comprising a transparent substrate, a photocatalyst-containing layer formed on the transparent substrate comprising at least a photocatalyst and a binder, and having a wettability which is changed so that a contact angle with a liquid is reduced by an energy irradiation, and the picture element part being provided on the photocatalyst-containing layer by a pattern of a plurality of colors with an ink jet system, ~~and wherein a component which prevents intermixture of colors is not formed at the border part of the picture element part;~~

wherein the photocatalyst-containing layer contains fluorine and the photocatalyst-containing layer is formed so that the fluorine content in a surface of the photocatalyst-containing layer is reduced by an action of the photocatalyst upon irradiating the photocatalyst-containing layer with the energy as compared with before the energy irradiation; and

wherein the fluorine content in a part in which the fluorine content is reduced by irradiating the photocatalyst-containing layer with the energy is 10 or less relative to 100 of the fluorine content of a part not irradiated with the energy.

30. (Previously Presented) The color filter according to Claim 29, wherein a space between the picture element parts is not more than $2\text{ }\mu\text{m}$.

31. (Previously Presented) A color filter, in which a shading part provided on a border part of a picture element part is not formed, comprising a transparent substrate, a photocatalyst-containing layer formed on the transparent substrate comprising at least a photocatalyst and a binder, and having a wettability which is changed so that a contact angle with a liquid is reduced by an energy irradiation, and the picture element part being provided on the photocatalyst-containing layer by a pattern of a plurality of colors with an ink jet system; and wherein an ink-repellent convex part is formed on the photocatalyst-containing layer at the border part of the picture element part.

32. (Previously Presented) A color filter, in which a shading part provided on a border part of a picture element part is not formed, comprising a transparent substrate, a picture element part provided on the transparent substrate by a pattern of a plurality of colors with an ink jet system, and a photocatalyst-containing layer formed on the border part of the picture element part comprising at least a photocatalyst and a binder, and having a wettability which is changed so that a contact angle with a liquid is reduced by an energy irradiation.

33. (Previously Presented) The color filter according to Claim 32, wherein the wettability on the transparent substrate is less than 10 degrees in terms of the contact angle with a liquid having the surface tension of 40 mN/m.

34. (Cancelled)

35. (Cancelled)

36. (Previously Presented) The color filter according to Claim 29, wherein the photocatalyst is one or more substances selected from the group consisting of titanium oxide (TiO_2), zinc oxide (ZnO), tin oxide (SnO_2), strontium titanate (SrTiO_3), tungsten oxide (WO_3), bismuth oxide (Bi_2O_3) and iron oxide (Fe_2O_3).

37. (Previously Presented) The color filter according to Claim 36, wherein the photocatalyst is titanium oxide (TiO_2).

38. (Previously Presented) The color filter according to Claim 37, wherein the photocatalyst-containing layer contains a fluorine element in a surface of the photocatalyst-containing layer at rate of 5 times more relative to the Ti element as determined by a X-ray photoelectron spectroscopy.

39. (Previously Presented) The color filter according to Claim 29, wherein the binder is organopolysiloxane having a fluoroalkyl group.

40. (Previously Presented) The color filter according to Claim 29, wherein the binder is organopolysiloxane which is a hydrolyzed and condensed compound or co-hydrolyzed and condensed compound of one or more of silicon compounds represented by $Y_nSiX_{(4-n)}$ wherein Y represents alkyl group, fluoroalkyl group, vinyl group, amino group, phenyl group or epoxy group, X represents alkoxyl group or halogen, and n is an integer of 0 to 3.

41. (Previously Presented) The color filter according to Claim 40, wherein a silicon compound having a fluoroalkyl group among the silicon compounds constituting the organopolysiloxane is contained at an amount of 0.01 mol% or more.

42. (Previously Presented) The color filter according to Claim 29, wherein a contact angle with a liquid having the surface tension of 40 mN/m on the photocatalyst-containing layer is not less than 10 degrees at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

43. (Previously Presented) The color filter according to Claim 29, wherein the picture element part colored with an ink jet system is a picture element part colored with an ink jet system using a UV-curing ink.

44. (Currently Amended) A process for producing a color filter, in which ~~neither a shading part nor a component which prevents intermixture of colors,~~ provided on a border part of a picture element ~~part, is~~ part is not formed, which comprises:

(1) a step of providing a photocatalyst-containing layer having a wettability of the energy-irradiated part which changes in a direction of reduction of the contact angle with a liquid, on a transparent substrate;

(2) a step of forming an exposed part for a picture element part by pattern-irradiating with energy on a picture element part forming portion on which the picture element part, on the photocatalyst-containing layer formed on the transparent substrate, is to be formed; and

(3) a step of coloring the exposed part for the picture element part with an ink jet system, to form the picture element part;

wherein the photocatalyst-containing layer contains fluorine and the photocatalyst-containing layer is formed so that the fluorine content in a surface of the photocatalyst-containing layer is reduced by an action of the photocatalyst upon irradiating the photocatalyst-containing layer with the energy as compared with before the energy irradiation; and

wherein the fluorine content in a part in which the fluorine content is reduced by irradiating the photocatalyst-containing layer with the energy is 10 or less relative to 100 of the fluorine content of a part not irradiated with the energy.

45. (Previously Amended) The process for producing a color filter according to Claim 44, wherein the step of forming the exposed part for the picture element part, then coloring the exposed part with the ink jet system to form the picture element part, comprises steps:

(a) a step of forming a first exposed part for a first picture element part by pattern-irradiating with energy on a part of the picture element part forming portion on which the picture element part, on the photocatalyst-containing layer, is to be formed;

(b) a step of forming the first picture element part by coloring the first exposed part for the first picture element part with the ink jet system;

(c) a step of forming a second exposed part for a second picture element part by irradiating with energy on a remaining part of the picture element part forming portion on which the picture element part, on the photocatalyst-containing layer, is to be formed; and

(d) a step of forming the second picture element part by coloring the second exposed part for the second picture element part with the ink jet system.

46. (Previously Presented) A process for producing a color filter, in which a shading part provided on a border part of a picture element part is not formed, which comprises:

- (1) a step of providing a photocatalyst-containing layer having the wettability of the energy-irradiated part which changes in a direction of reduction of the contact angle with a liquid, on a transparent substrate;
- (2) a step of forming an exposed part for an ink-repellent convex part by pattern-irradiating with energy on an ink-repellent convex part forming portion on which the ink-repellent convex part, on the photocatalyst-containing layer formed on the transparent substrate, is to be formed;
- (3) a step of forming the ink-repellent convex part by applying an ink to the exposed part for an ink-repellent convex part;
- (4) a step of forming an exposed part for a picture element part by irradiating with energy on a picture element part forming portion on which the picture element part, on the photocatalyst-containing layer formed on the transparent substrate, is to be formed; and
- (5) a step of coloring the exposed part for the picture element part with an ink jet system, to form the picture element part.

47. (Previously Presented) The process for producing a color filter according to Claim 46, wherein the ink-repellent convex part is formed between the picture element parts.

48. (Previously Presented) A process for producing a color filter, in which a shading part provided on a border part of a picture element part is not formed, which comprises:

- (1) a step of providing a photocatalyst-containing layer having a wettability of an energy-irradiated part which changes in a direction of reduction of a contact angle with a liquid, at the border part of a picture element part forming portion on which the picture element part is to be formed, on a transparent substrate; and
- (2) a step of forming the picture element part on the picture element part forming portion on the transparent substrate.

49. (Currently Amended) The process for producing a color filter according to ~~claim 22~~ Claim 48, wherein the wettability on the transparent substrate is less than 10 degrees as the contact angle with a liquid having the surface tension of 40 mN/m.

50. (Previously Presented) The process for producing a color filter according to Claim 44, wherein the contact angle on the photocatalyst-containing layer with a liquid having a surface tension of 40 mN/m is 10 degrees or more at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

51. (Currently Amended) The process for producing a color filter according to ~~Claim 48~~, Claim 46 wherein the contact angle on the photocatalyst-containing layer with a liquid having a surface tension of 40 mN/m is 10 degrees or more at a part not irradiated with the energy and less than 10 degrees at a part irradiated with the energy.

52. (Previously Presented) The process for producing a color filter according to Claim 44, wherein the step of coloring the exposed part for the picture element part with the ink jet system uses a UV-curing ink.

53. (Previously Presented) The process for producing a color filter according to Claim 48, wherein the step of coloring the exposed part for the picture element part with the ink jet system uses a UV-curing ink.

54. (Previously Presented) A liquid crystal panel comprising a color filter according to Claim 29 and a substrate which are opposite to the color filter, and provided a shading part, wherein a liquid crystal compound is encapsulated between both substrates.